

ANALOG CCD TV CAMERA - 8



CCD CAMERA N23

*TV CAMERA FOR USE WITH
X-RAY IMAGE INTENSIFIER*



Service Manual

October 2004 Release 1

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1. INTRODUCTION

The CCD camera N23 system acquires and digitizes radiological images.

This equipment must be used in accordance with the manual and is not intended for any use outside of that herein described.

The N23 is a device component and interfaces to x-ray equipment and as such must be used by qualified personnel only with knowledge of all x-ray protection.

The user is also responsible for all additional compliance certification and correct function at time of installation.

2. SAFETY INSTRUCTIONS

NICAL S.p.A. accepts no responsibility for any misuse of the CCD camera N23 outside of its original design and description as set forth in manual.

Furthermore NICAL S.p.A accepts no responsibility for any damages to camera, operator, and patient, due to incorrect installation or unauthorized modification (mechanical or electrical) and misuse of N23 CCD system.

Only personnel authorized by NICAL S.p.A may service equipment.

Authorized persons may only remove covers when servicing electrical power concerns.

It is mandatory to replace parts with only original NICAL S.p.A. replacement components.

2.1. *Warnings*

1. Read these instructions carefully. Save these instructions for future reference.
2. Follow all warnings and instructions marked on the product.
3. Slots and openings in the cabinet are provided for ventilation; to ensure reliable operation of the product and to protect it from overheating, these openings must not be blocked or covered.
4. This product should be operated from the type of power indicated on the marking label. If you are not sure of the type of power available, consult NICAL Company.
5. When the CCD camera is turned on make a white test in according to verify the quality image.

2.2. *Environmental risks and disposal*

The CCD CAMERA N23 contains some materials that can be recycled at the end of its life cycle.

In particular the system contains the following materials:

- Iron, copper, lead, aluminium, non-biodegradable plastics, and fiber of glass printed circuit boards.

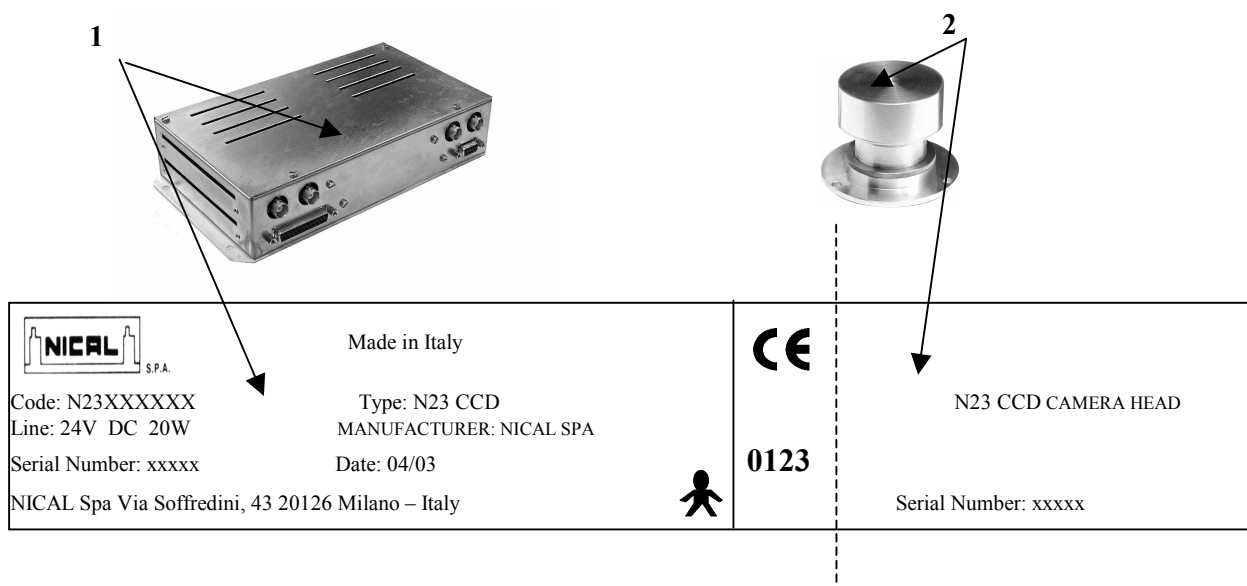
NICAL S.p.A. does not accept equipment for recycling.

2.3. *Symbols*

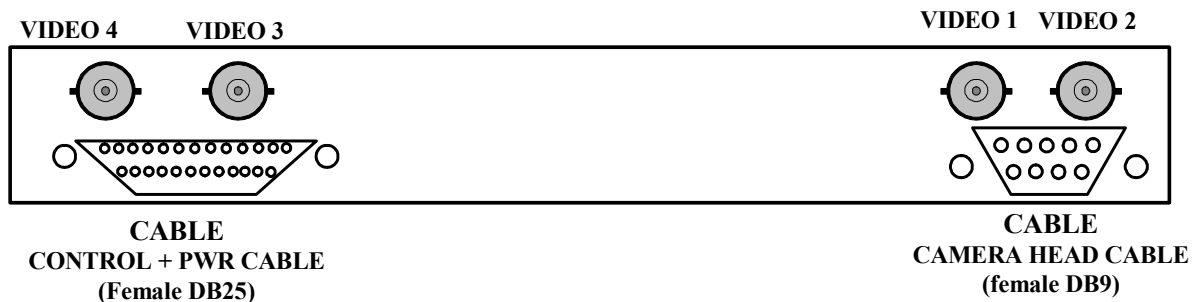
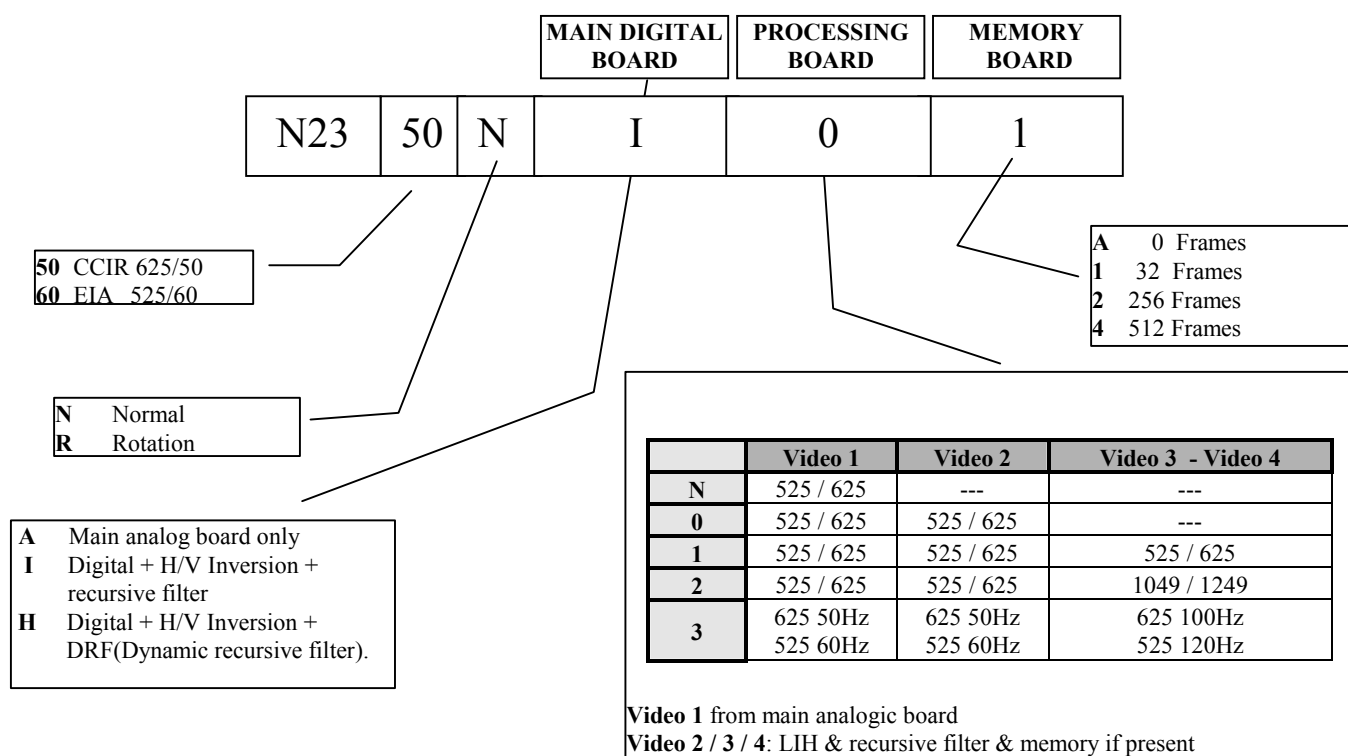
Symbol	Description
	Attention, consult the documentation
DC	Direct current
	Compliance to Medical Device directive:93/42
	Device with type B parts
	Protective earth (ground)

3. DESCRIPTION

3.1. Identification labels



3.2. Description



4. TECHNICAL DATA & CERTIFICATIONS

Available CCD scanning system : Scanning aspect ratio:	CCIR 625/50 interlaced (752 x 582 pixels) EIA 525/60 interlaced (768 x 494 pixels) 4:3
CCD Camera Head : CCD Type: Integrated optical lens system: Image intensifier output screen: Mounting frames:	½" Interline low blooming CCD sensor (470.000 pixels) High resolution with adjustable focus and diaphragms From 15 to 40mm diameter. From 6" inch to 16" inch I.I.
CCD / CCU Characteristics : Resolution: Gamma correction: Video output A/D converter: Video Bandwidth: DRF (Dynamic Recursive Filter): MD (Motion Detection): Standard Recursive filter: Memory: Automatic video level compensation: Automatic x-ray kV/mA compensation: Dynamic contrast compensation for better image uniformity: Very high dynamic video amplifier: High precision electronic circle: Video output signal:	20 lines-pairs (on 6" image intensifiers) 0.4 or 1 10 bits 20 MHz ± 3dB Yes (N23H) Yes (N23) Factor 2,4,8,16 16 bits Yes Yes. Analog and digital (up/down) Yes (shading) Yes Yes 1 Vpp (0.3 Vpp Sync)
Video output standards : Analog Main board (Video 1): Digital Main board (Video 2) recursive filter and/or DRF & LIH & frame stored: Digital processing board (Video 3) (Video 4):	1 BNC 75Ω - (CCIR 625/50 or EIA 525/60) 1 BNC 75Ω - (CCIR 625/50 or EIA 525/60) 2 BNC 75Ω CCIR 625/50 interlaced EIA 525/60 interlaced CCIR 1249/50 interlaced EIA 1049/60 interlaced CCIR 625/100Hz interlaced EIA 525/120Hz interlaced
Operating conditions : Working temperature range: Store temperature range: Humidity:	-10°C to +45°C -40°C to +55°C Operating to 95% relative humidity (non-condensing)
Mechanical specifications : Control unit: dimension (WxDxH)/ Weight: Camera head: dimension (φ x H)/Weight:	226 x 120 x 46mm 0,550 Kg (Standard) 85x87mm 0,460 Kg (with Rotation) 101x87mm 1,1 Kg
Available power supply :	24Vdc ± 20%
Approvals : Safety: EMC: Others:	EN 60601-1 EN 60601-1-2 CE-label according 93/42 CEE directive for medical devices.
Options :	360° Continuous rotating camera head (with slip ring) C-Mount Zoom lens Neutral density filter: 25% or 50% light transmission

5. MAINTENANCE AND CLEANING

5.1. *Maintenance*

The system will serve you well if you take care of it.

- Do not spill liquids on the system.
- Do not subject the system to heavy shock and vibration.
- Never place objects on top of the system to avoid damaging it.
- All electrical equipment should be used according to the instruction provided. It is advised to control all connections and the image quality on a regular basis. It will guarantee an efficient function and long product life.

Maintenance guide

Frequency	Description
2 years	Cable connection and condition inspection
1 year	Image quality check

5.2. *Cleaning*

When cleaning the system, follow these steps:

- Power off the system.
- Use a soft cloth moistened with water.
- Do not use liquid or solvents.

6. CCD CAMERA N23 DESCRIPTION

The N23 CCD camera, manufactured using printed circuit board with SMD technology, offers better performance than NICAL' s well know N20 camera system. It uses the same camera head of CCD camera N20 and the same wiring and controls. All previously offered configurations are available in the new system along with vertical-horizontal inversion and continuous 360° rotation. Digital integrated image processing has been changed from 9 to 10 bit output resolution for better performance. This new system allows obtaining 512 frames memory with icons and numbered frames displayed. These new characteristics put the new N23 CCD at the top of the standard resolution CCD cameras for x-ray image intensifier and radiological applications.

A very important new feature available on N23H is DRF (Dynamic Recursive Filter) which allows changing pixel by pixel the recursive filter factor. This type of filter offers better photonic noise reduction, eliminating also image persistence during patient moving.

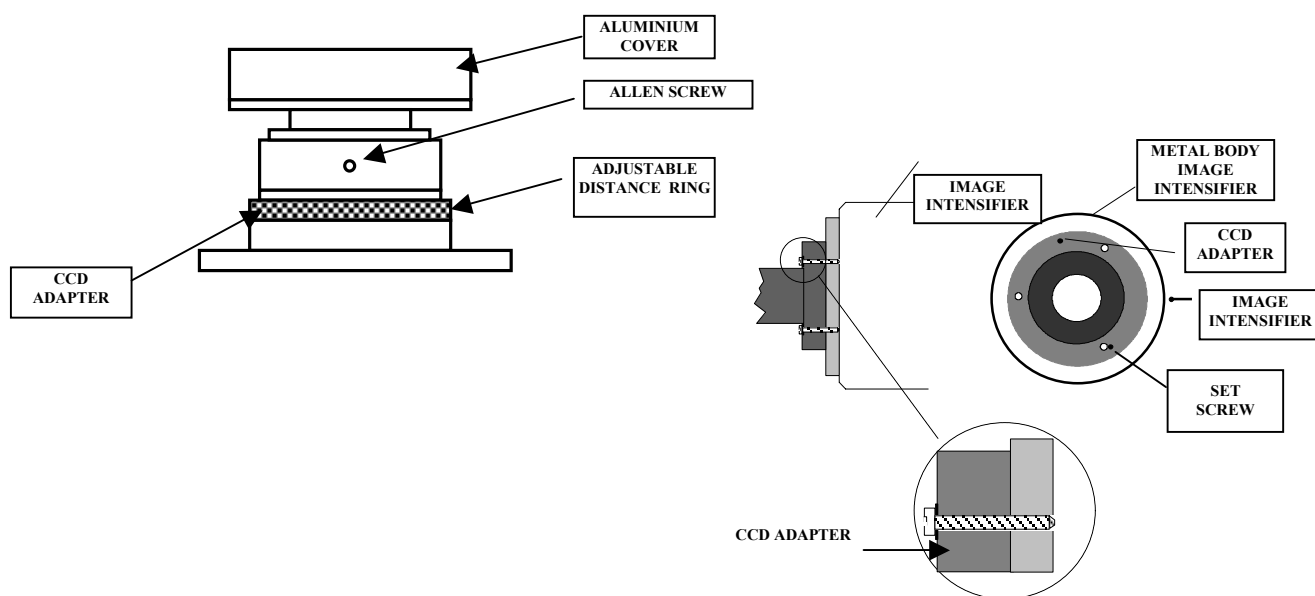
7. COMPONENT POSITIONS

7.1. *POSITIONING OF CAMERA HEAD*

Place camera head into output phosphor well of image intensifier (see figure below).

Line up holes at 120° and fasten with screws to intensifier. If necessary it is possible rotate camera head 90° by 90° with screws at the bottom of the cover head.

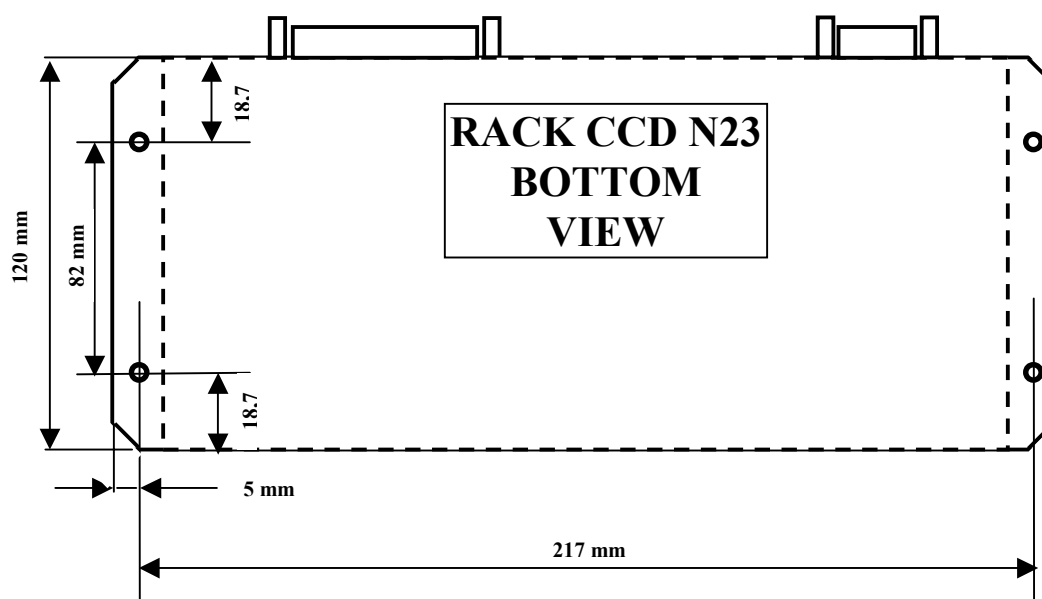
NOTE: For best performance it's better to **insulate the camera head from the ground system**. For this reason the camera head has a special superficial treatment to insulate the head when it is fixed with screws to the system. Be sure to use plastic insulation with screw to fix head at the system.



7.2. *POSITIONING OF CCU*

Line up holes at the bottom of the cover CCU and fasten with screws to the system.

NICAL COMPANY DOES NOT PROVIDE THE SET SCREWS



8. STANDARD INSTALLATION

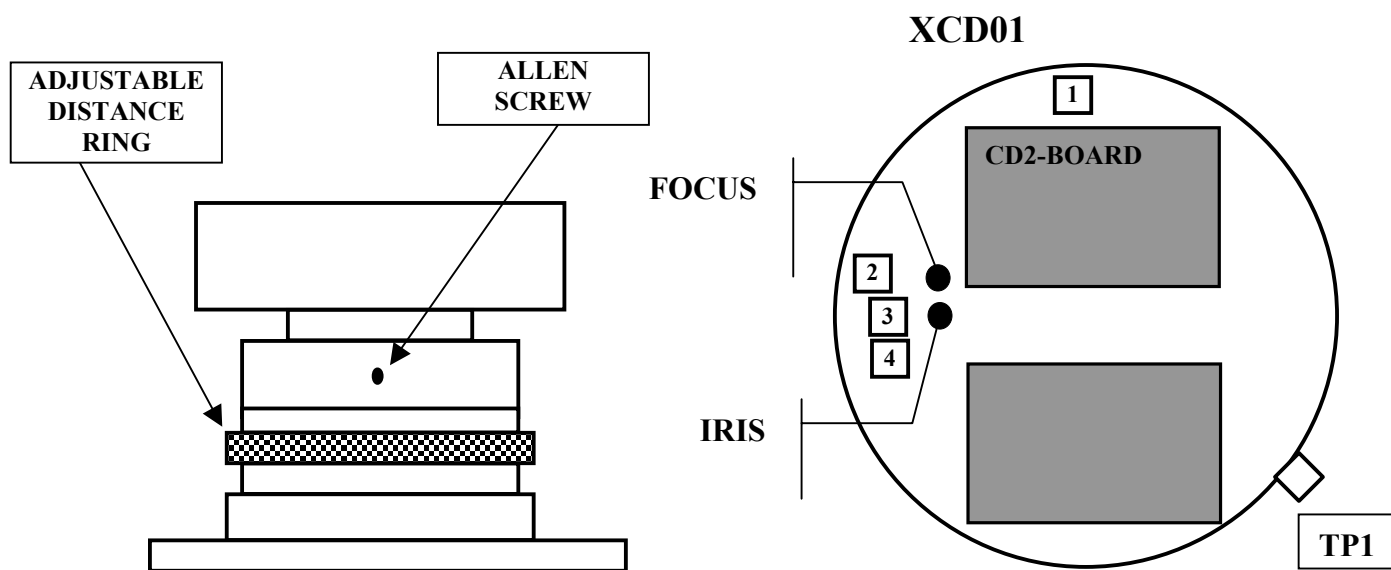
All the CCD cameras are calibrated in Nical Company and the customer may regulate the following functions only:

1. DISTANCE (IMAGE DIMENSION)
2. FOCUS OF THE CCD CAMERA HEAD
3. IRIS OF THE CCD CAMERA HEAD
4. SHADING REGULATION

The parts where it is possible to find these regulations are:

- | | |
|-------|-----------------|
| 1-2-3 | CCD CAMERA HEAD |
| 4 | N23_ANB1 BOARD |

8.1. *Camera Head (CCD head adjustments)*



DISTANCE (IMAGE DIMENSION)

SET TO REQUIRED PICTURE DIMENSION.
UNLOCK THE ALLEN SCREW, ADJUSTABLE DISTANCE RING AND ROTATE THE INTERNAL CYLINDER UNTIL THE REQUESTED DISTANCE.

FOCUS

SET FOR BEST FOCUS BETWEEN IMAGE INTENSIFIER AND CAMERA HEAD

DIAPHRAGM

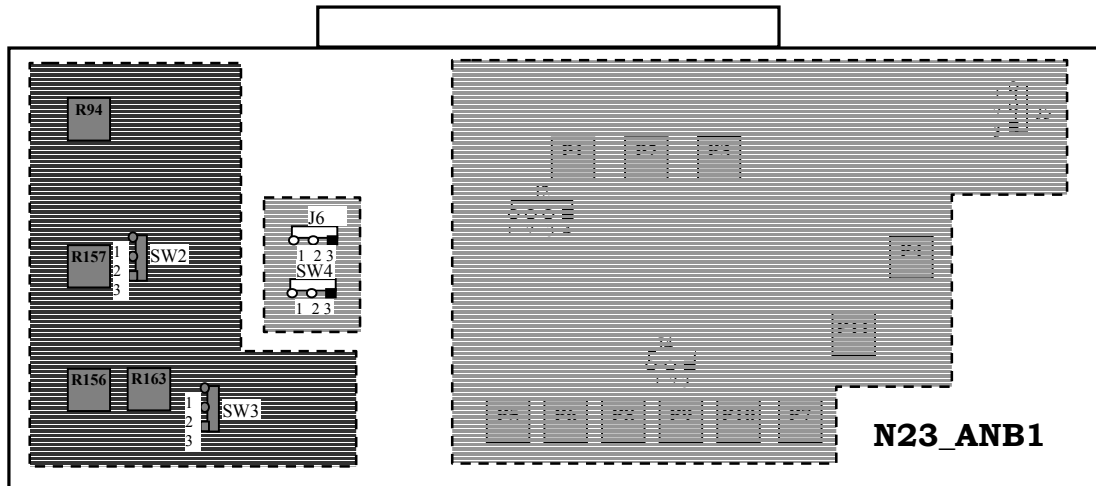
WITH STANDARD DOSE REQUESTED, SET SCREW OF IRIS UNTIL THE 2 LEDS ON N23_ANB1 TURN OFF. (In these conditions the value of video signal is equal to 1,3V at test point (TP1))

8.2. *CCU adjustment*

SHADING

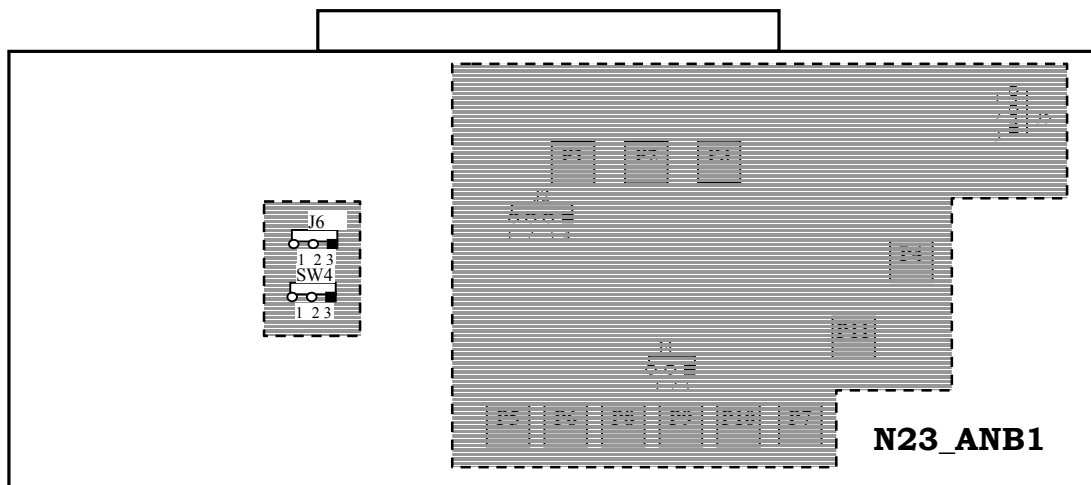
MOVE JUMPER J4 (SHADING) ON N23_ANB1 BOARD FROM POSITION 1-2 (OFF) TO POSITION 2-3 (ON), AND ADJUST P7, P8, P9, P10 FOR BEST IMAGE UNIFORMITY (using flat x-ray image at standard dose).

8.3. Set up points



CODE	NAME	DESCRIPTION
SW2	AUTO BLK	It is used to enable the Black Level Auto Control. (SW2 ON: position 1-2)
R157	BLACK LEVEL	Ad just black level pedestal (BOTTOM BLACK). When Auto BLK off (SW2 OFF: position 2-3) regulate the pedestal to 30mV respect referring level
R156	BLACK LEVEL AUTO CONTROL	Ad just black level pedestal (BOTTOM BLACK). When Auto BLK on (SW2 ON: position 1-2) regulate the pedestal to 30 mV respect referring level.
SW3	AUTO WTH	It is used to enable the Auto White Level. (SW3 ON: position 1-2)
R163	AUTO WHITE LEVEL	Ad just white level (TOP WHITE). Set to 590mV video analog signal respect referring level. Use jumper SW3=ON (position 1-2) to select or reject this feature.
R94	GAMMA	Factory adjusted
SW4	ANALOG VIDEO (2-3) /SYNC PULSE PER SCOPIA PULSATA (1-2)	It is used to enable on Video 1 an analogic signal: (position 2-3) or an output at 25Hz/30Hz square wave (position 1-2) used as sync pulse in high contrast
J6	GAMMA CORRECTION	Jumper J6 position 1-2: gamma value is 0, 4. Jumper J6 position 2-3: gamma value is 1
J4	SHADING ENABLE	It is used to enable shading regulations
P7-P8-P9-P10	SHADING (VS-VP-HS-HP)	Set the shading gain to compensate picture not uniformity because of Image Intensifier. Use jumper J4=ON (position 2-3) to select or reject this feature
J2	VIDEO & AUTO CIRCLE ENABLE	It is used to enable the video and auto video regulations J2 position 3-4: VIDEO CIRCLE; J2 position 2-3 AUTO CIRCLE
P6	VIDEO CIRCLE	Adjust circle blanking diameter. Use jumper J2=ON (position 3-4) to select or reject this feature
P5	AUTO CIRCLE	Adjust measurement circle area used by automatic gain and x-ray KV control. Use jumper J2=ON (position 2-3) to select or reject this feature
P3	CIRCLE SIMMETRY	Adjust the symmetry of video circle. Use jumper J2=ON (position 3-4) to select or reject this feature
P1	VERT SHIFT	Adjust the vertical centering of video circle. Use jumper J2=ON (position 3-4) to select or reject this feature
P2	HOR SHIFT	Adjust the horizontal centering of video circle. Use jumper J2=ON (position 3-4) to select or reject this feature
P4	AUTO KV LEVEL	Set the value of AUTO KV
P11	AUTO KV WINDOW	Increase or decrease the sensibility of the automatic KV control. This feature is very useful in according to adapt the CCD camera N23 for any kind of X-ray generator
J5	ROTATION RESET (CCD CAMERA WITH ROTATION ONLY)	Position 2-3: Automatic reset when system turned -on. Position 1-2: Manual reset. To bring camera head to 0 position ground pins CW (pin 17) and CCW (pin 4) on interface connector DB25 at the same time. Location: N23- MB0.

8.4. Customer Set up



SHADING

Using correct dose uniformity, regulate the trimmers P7, P8, P9 e P10 until to obtain on the monitor the maximum uniformity. The jumper J4 enables or rejects this regulation.

KV AUTO

It is possible to change the answer sensibility of control system dose. In according to change the sensibility, use trimmer P11. The trimmer P4 changes the action point of the control (video level).

CIRCLE

Using trimmer P6 it is possible to change the diameter of video circle. The trimmer P5 regulates the circle area where it finds the dose automatic control (ROI). In according to select the video or the auto circle move the jumper J2. The trimmers P1, P2 and P3 regulate the centering and the symmetry.

GAMMA CORRECTION

It is possible change the gamma value. Moving jumper J6 in position 1-2 the gamma level corresponds to 0, 4; while moving jumper J6 in position 2-3 the gamma level is equal to 1.

VIDEO 1 OUTPUT

On BNC VIDEO 1 are possible changing two signals:

Analogic video 1Vpp 75Ω or a square wave signal 5Vpp at 25Hz/30Hz in according to sync x-ray systems in pulsed fluoroscopy.

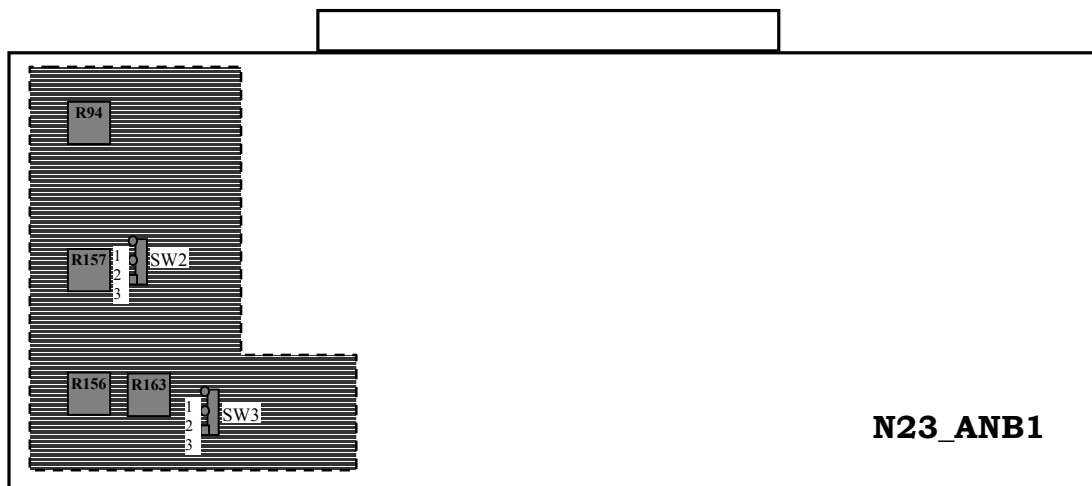
To obtain the analogic video move jumper SW4 in position 2-3; while to obtain the square wave signal move jumper SW4 in position 1-2.

ROTATION

In the systems where the CCD camera head has the rotation:

1. Manual reset. (Factory default). Jumper J5 position 1-2. To bring camera head to 0 position ground pins CW (pin 17) and CCW (pin 4) on interface connector DB25 at the same time.
2. Automatic reset when system turned on. Jumper J5 position 2-3.

8.5. *Factory set up only*



VIDEO AUTO LEVEL

The system includes an automatic control of white (WH) and of black (BK).

The trimmer R157 regulates the level of black SET UP when there is not the image. Set up this trimmer in according to obtain a black-level of 20÷30mV.

The trimmer R156 reduces in automatic way the black-level to compensate the diffusion radiation. Using a phantom which simulates human body, regulate this trimmer until to obtain a good black-level when it presents diffusion radiation. It is possible reject this automatic control moving the jumper SW2 (position 1-2: on; position 2-3: OFF).

The trimmer R163 regulates the level of white automatic control (WH). Using a standard phantom and with white automatic control on regulate this trimmer until to obtain a correct video signal. It is possible reject this control by jumper SW3 (position 2-3) and also by the command AUTO-OFF (pin 2 25DB connector).

GAMMA

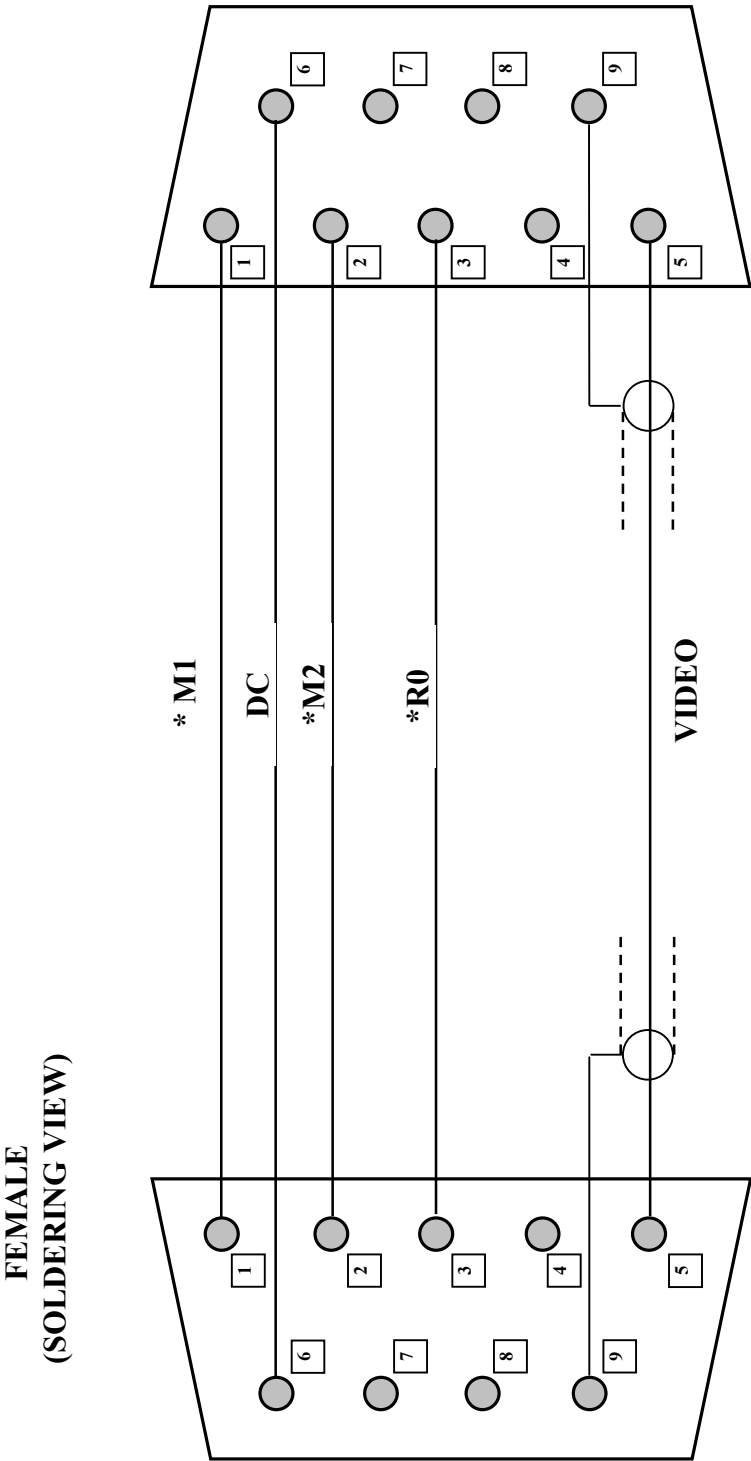
The system is adjustable in according to have a gamma 0, 4. The gamma value can be modified to 1 moving jumper J6. The video level of gamma correction is adjustable using trimmer R94 and it never must modify other than it necessary to change some components. In according to make these adjustments apply a video input (CCD camera head) of 3Vpp and regulate this trimmer until to obtain a value of 0,7Vpp on output VIDEO 1.

9. CCD CAMERA CONNECTORS

The CCD camera N23 connectors can be divided as follow:

- 1. **CCD CAMERA HEAD CONNECTOR (DB9)**
- 2. **COMMANDS INTERFACE CONNECTOR (DB25)**

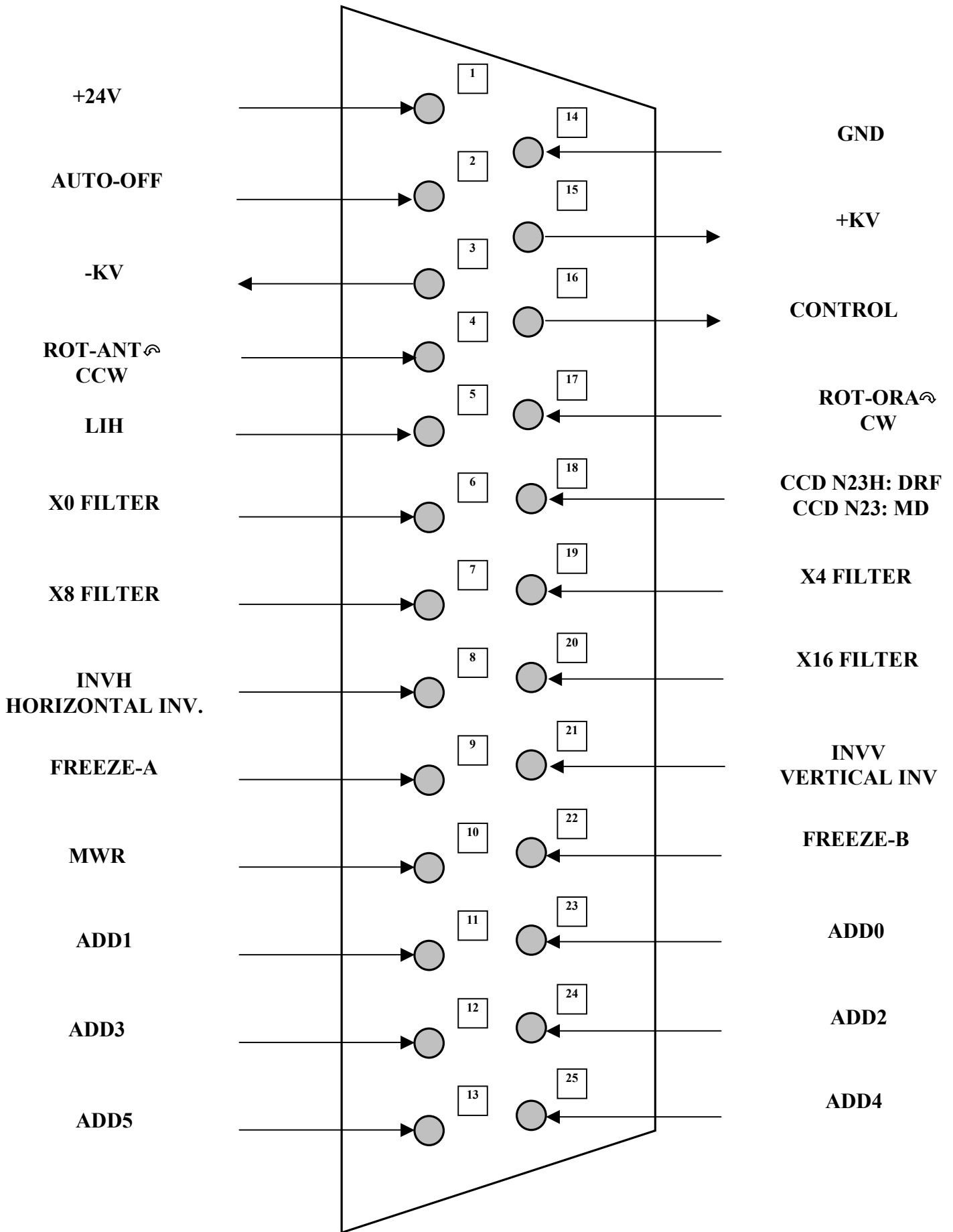
9.1. *CCD camera head connector*



***: ONLY FOR ROTATION**

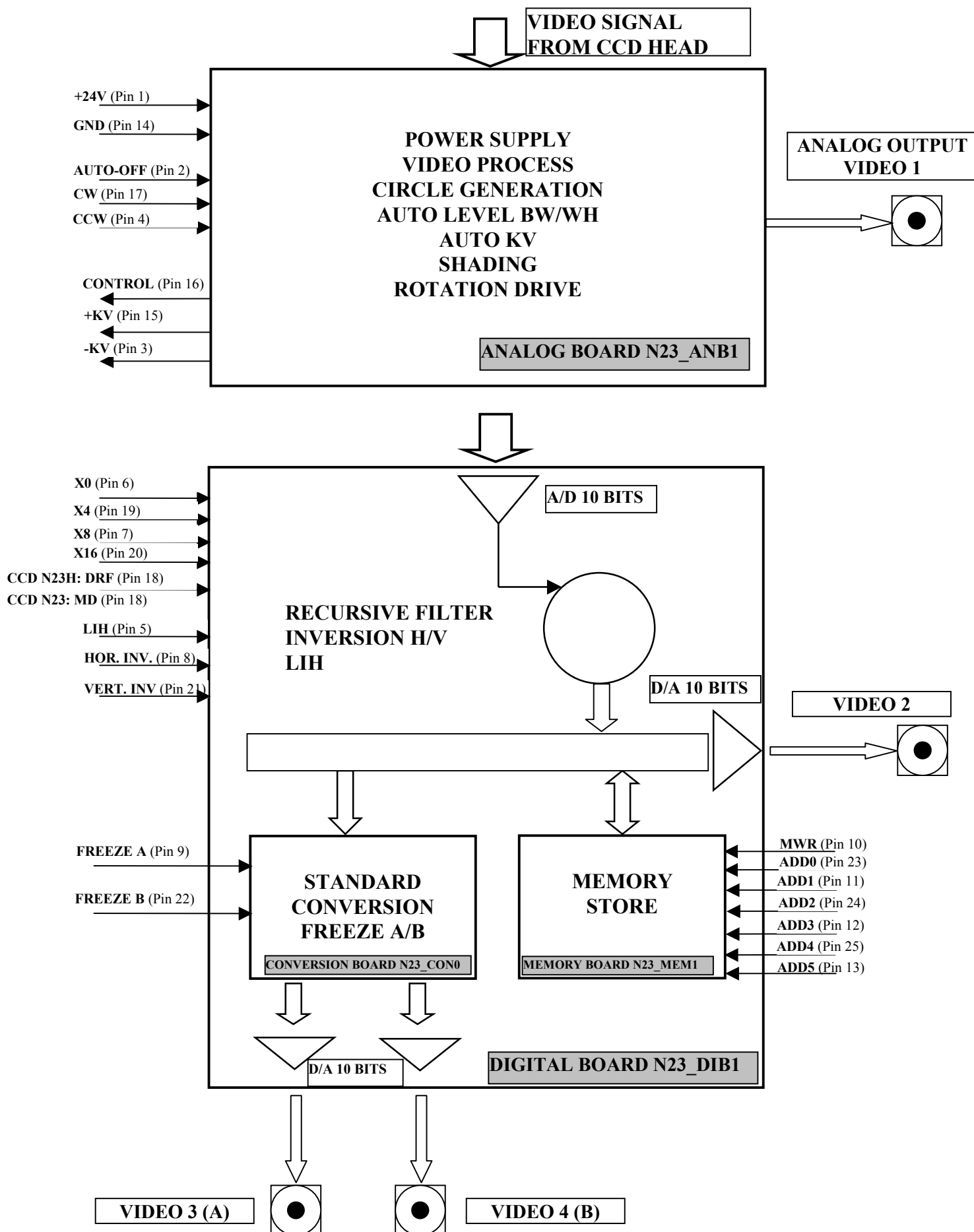
COMMAND	DESCRIPTION
M1 PIN 1	Command motor 1
DC PIN 6	Power Supply
M2 PIN 2	Command motor 2
R0 PIN 3	Command rotation 0
GND PIN 9	Ground video signal
VIDEO PIN 5	Video signal

9.2. Command



NAME	SIGNAL	PIN	DESCRIPTION
+24V	IN	1	POWER SUPPLY: 20÷30 V
GND	IN	14	GROUND REF.
AUTO-OFF	IN	2	AUTOMATIC WHITE LEVEL. OPEN: ON GND: OFF
-KV	OUT	3	OUT= +18V IF DOSE IS TOO LOW. OUT= 0V IF DOSE IS CORRECT OR TOO HIGH.
+KV	OUT	15	OUT= +18V IF DOSE IS TOO HIGH. OUT= 0V IF DOSE IS CORRECT OR TOO LOW.
CONTROL	OUT	16	ANALOG KV CONTROLL. OUT= 0÷12 V. OUT = 0V IF DOSE IS TOO LOW. OUT = 12V IF DOSE IS TOO HIGH. OUT = 6V IF DOSE IS BALANCED.
ROT-ORA CW	IN	17	GND: CLOCK WISE ROTATION. IF GND AT THE SAME TIME WITH PIN 4 (ROT-ANT) RESET TO 0° ANGLE.
ROT-ANT CCW	IN	4	GND: ANTI CLOCK WISE ROTATION. IF GND AT THE SAME TIME WITH PIN 11 (ROT-ORA) RESET TO 0° ANGLE
LIH	IN	5	OPEN: LIVE IMAGE GND: LAST IMAGE OLD
DRF CCD N23H	IN	18	OPEN: DYNAMIC RECURSIVE FILTER GND: STANDARD RECURSIVE FILTER
MD CCD N23	IN	18	OPEN: MOTION DETECTION GND: STANDARD RECURSIVE FILTER
X0, X4, X8, X16 ALL HIGH LEVEL			NOISE FILTER = 2
X0	IN	6	GND: NOISE FILTER = 0
X4	IN	19	GND: NOISE FILTER = 4
X8	IN	7	GND: NOISE FILTER = 8
X16	IN	20	GND: NOISE FILTER = 16
INVH HOR. INV.	IN	8	OPEN: REAL IMAGE GND: HORIZONTAL IMAGE INVERSION
INVV VERT. INV.	IN	21	OPEN: REAL IMAGE GND: VERTICAL IMAGE INVERSION
FREEZE-A	IN	9	OPEN: LIVE IMAGE GND: FREEZE THE IMAGE IN VIDEO 3
FREEZE-B	IN	22	OPEN: LIVE IMAGE GND: FREEZE THE IMAGE IN VIDEO 3
MWR	IN	10	SEE MEMORY OPERATION
ADD0	IN	23	SEE MEMORY OPERATION
ADD1	IN	11	SEE MEMORY OPERATION
ADD2	IN	24	SEE MEMORY OPERATION
ADD3	IN	12	SEE MEMORY OPERATION
ADD4	IN	25	SEE MEMORY OPERATION
ADD5	IN	13	SEE MEMORY OPERATION

9.3. Block diagram CCU rack N23



10. FUNCTION AND MEMORY CONTROL

10.1. *Memory function of CCD camera*

The pins used for memory function are the following 10;
LIH, FREEZE_A, FREEZE_B, MWR, ADD0, ADD1, ADD2, ADD3, ADD4, ADD5.
There are 5 memory modes listed below.

- **Direct access mode.** Allows the recording or display of the first 32 positions of memory.
- **Manual selection mode.** Allows the user to move indicator to desired position to guarantee recording/playback at a specific position.
- **Multiple Cine-Loop mode without reset.** Allows the recording/ playback of images in sequential order at a selected speed starting from actual indicator position.
- **Single Cine-Loop Mode with reset.** Allows the recording/playback of images in sequential order at a selected speed starting from initial (first) indicator position.
- **Erasing Memory.** Allows the erasing of the full memory.

10.2. *Recording to and playback from memory modes.*

The MWR write/read command signal manages the memory storage operations described as follow:

ATTENTION: 0 = GROUND 1 = OPEN

MWR	DESCRIPTION
0	Memory Write. If MWR= GND user can record an image to the memory. The video input (Live or LIH) present on BUS is transferred to the memory at the position where indicator is found and with selected mode. (See list of modes.)
1	Memory Read. If MWR= OPEN (1) user can playback an image from the memory. The frame displayed will correspond to indicator position at this time. The frame will be transferred to BUS with selected mode. (See list of modes.)

Monitor visualization (APPLICATIONS):

MWR	FREEZE A	FREEZE B	LIH	DESCRIPTION
0	X	X	1	Write memory with the image present on BUS (LIVE), for all the setting-value of the other 3 commands.
1	X	X	1	LIVE (images from camera head) Memory stand-by.
1	1	X	0	Read memory frames and images are transferred on monitor A
1	X	1	0	Read memory frames and images are transferred on monitor B
1	1	1	0	Read memory frames and images are transferred on both monitor A and B
X	0	X	X	FREEZE A. Image on monitor A frozen.
X	X	0	X	FREEZE B. Image on monitor B frozen.

10.3. Direct access memory (ADD5=1)

ADD5	ADD4	ADD3	ADD2	ADD1	ADD0	DESCRIPTION
1	1	1	1	1	1	If MWR=0 the image on the BUS (Live or LIH) is recorded at the first position. If MWR =1 the recorded image is read at position 1 and transferred to BUS for display
1	1	1	1	1	0	Same as above record/read memory at position 2
1	1	1	1	0	1	Same as above record/read memory at position 3
1	1	1	1	0	0	Same as above record/read memory at position 4
1	1	1	0	1	1	Same as above record/read memory at position 5
1	1	1	0	1	0	Same as above record/read memory at position 6
1	-	-	-	-	-	Same as above record/read memory for the others position
1	0	0	0	0	0	Same as above record/read memory at position 32

10.4. Manual selection mode (ADD5=0, ADD1=1, ADD0=0)

ADD5	ADD4	ADD3	ADD2	ADD1	ADD0	DESCRIPTION
0	RESET	0=DWN 1=UP	CLK 	1	0	MANUAL UP OR DOWN MODE
0	1	1	CLK 	1	0	(UP) The indicator of frame memory position is moved to the next successive position. (position $\Leftarrow$ position+1)
0	1	0	CLK 	1	0	(DOWN) The indicator of frame memory position is moved to preceding frame in memory. (position $\Leftarrow$ position-1)
0	CLK 	X	X	1	0	(RESET) The indicator of frame memory position is moved to initial frame of stored image sequence. (position = 1)

10.5. Multiple cine-loop mode without position reset (ADD5=0, ADD1=0, ADD0=1)

ADD5	ADD4	ADD3	ADD2	ADD1	ADD0	DESCRIPTION
0	X	X	X	0	1	MULTIPLE CINE-LOOP MODE WITHOUT RESET In this mode the record/playback starts from the actual position found. (MWR) increasing frame by frame automatically at the selected speed rate. In this mode it is possible to acquire a series of different segmented images at various times. During a successive playback of all the images in the memory it is possible to read the different phases of an exam recorded at different times.
0	1	1	1	0	1	<u>Speed 25 (30) Frames per second</u> When MWR=0 images are acquired into the memory at 25 (30) fps. Starts at actual position of indicator. When MWR=1 images are read (playback) from memory at 25 (30) fps. Starts at actual position of indicator.
0	1	1	0	0	1	<u>Speed 12 (15)fps</u>
0	1	0	1	0	1	<u>Speed 6 fps</u>
0	1	0	0	0	1	<u>Speed 3 fps</u>
0	0	1	1	0	1	<u>Speed 1 fps</u>
0	0	1	0	0	1	<u>Speed 0.5 fps</u>
0	0	0	1	0	1	<u>Speed 0.25 fps</u>
0	0	0	0	0	1	<u>Single Shot</u> When MWR=0 the user acquires ONE image into memory at the actual position of indicator. When MWR=1 the user can read ONE image from the memory at the actual position of indicator. In both cases the frame number is automatically increased to the next position after the recording or the playback of an image

10.6. Multiple cine-loop mode with position reset (ADD5=0, ADD1=0, ADD0=0)

ADD5	ADD4	ADD3	ADD2	ADD1	ADD0	DESCRIPTION
0	X	X	X	0	0	MULTIPLE CINE-LOOP MODE WITH RESET During this mode the recording or playback always starts at the first position (position = 1) regardless of the position of the frame number indicator at MWR. The frame memory number position increases automatically at the selected frame rate speed.
0	1	1	1	0	0	<u>Speed 25 (30) Frames per second</u> When MWR=0 images are acquired into the memory at 25 (30) fps starting at position =1. When MWR=1 images are read at 25 (30) fps starting at position=1.
0	1	1	0	0	0	<u>Speed 12 (15)fps</u>
0	1	0	1	0	0	<u>Speed 6 fps</u>
0	1	0	0	0	0	<u>Speed 3 fps</u>
0	0	1	1	0	0	<u>Speed 1 fps</u>
0	0	1	0	0	0	<u>Speed 0.5 fps</u>
0	0	0	1	0	0	<u>Speed 0.25 fps</u>
0	0	0	0	0	0	<u>Single Shot</u> When MWR=0 The memory acquires ONE image only starting at position = 1 When MWR=1 only ONE image is read from the memory at position=1. In both cases the memory increases automatically frame by frame during recording or playback.

10.7. Erasing memory mode (ADD5=0, ADD1=1, ADD0=0)

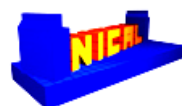
ADD5	ADD4	ADD3	ADD2	ADD1	ADD0	DESCRIPTION
0	X	X	X	1	1	ERASING MEMORY
0	0	0	0	1	1	Full erasing memory if signals contemporary GND more than 1,5 sec.

11. ELECTRICAL DIAGRAMS

11.1. General circuit diagram and block diagram of N23 CCD system.

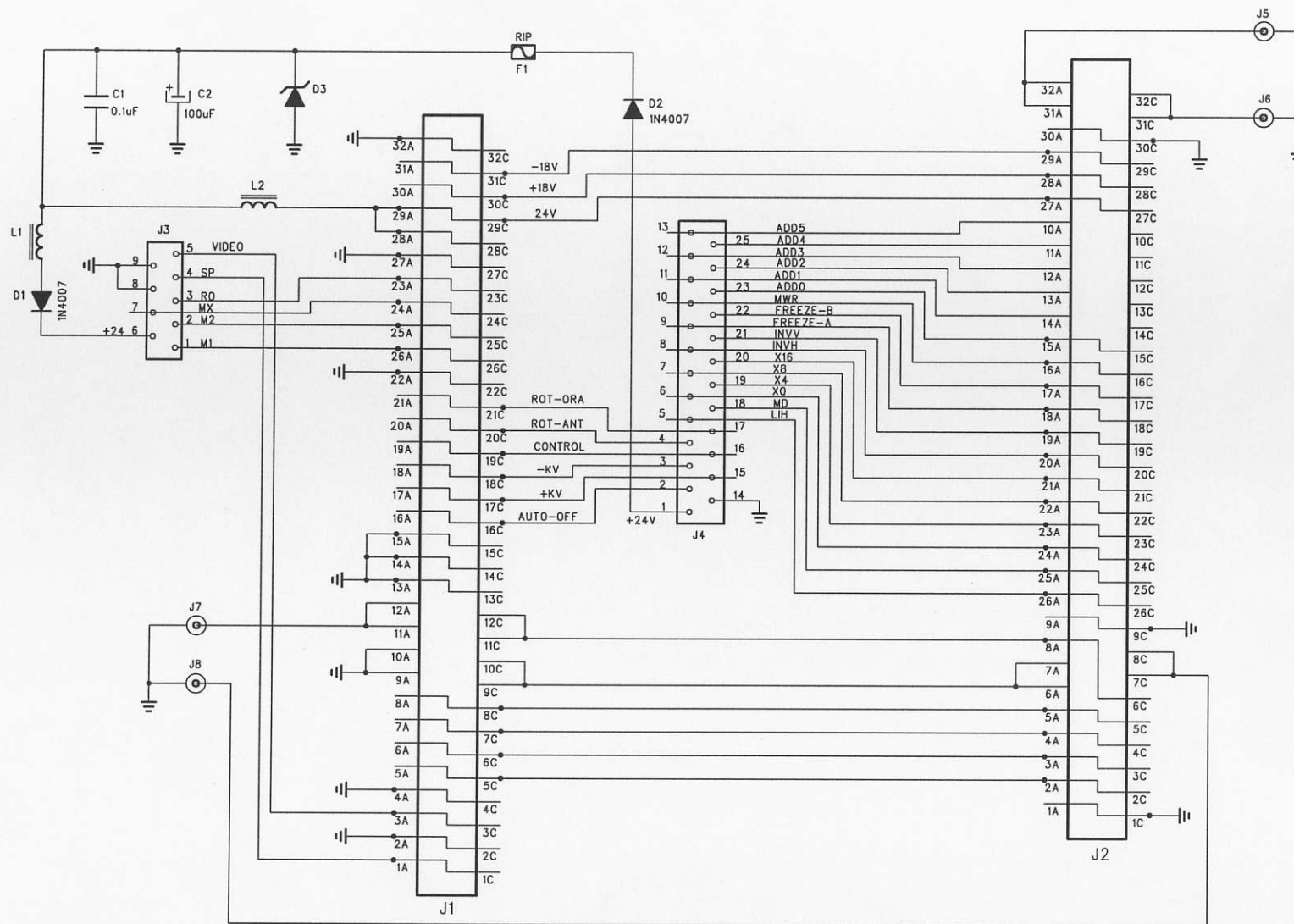
Boards	Description
N23_MB0	Mother board N23
N23_ANB1	Video board diagram, Auto KV, electronic circle generator and camera head rotation
N23_DIB1	Digital board diagram, A/D converter, LIH, sweep reversal, recursive filter and DRF.
N23_CON0	Conversion board diagram, standard video and inversion
N23_MEM1	Memory frames diagram
NCD_XCD01	CCD sensor block
NCD_XCD02	Power supply board CCD head

NICAL S.p.A.
Via Soffredini, 43
20126 – Milano
ITALY
Tel.+39-02-2571110
FAX.+39-02-2572207



email: nical@nical.com
<http://www.nical.com>





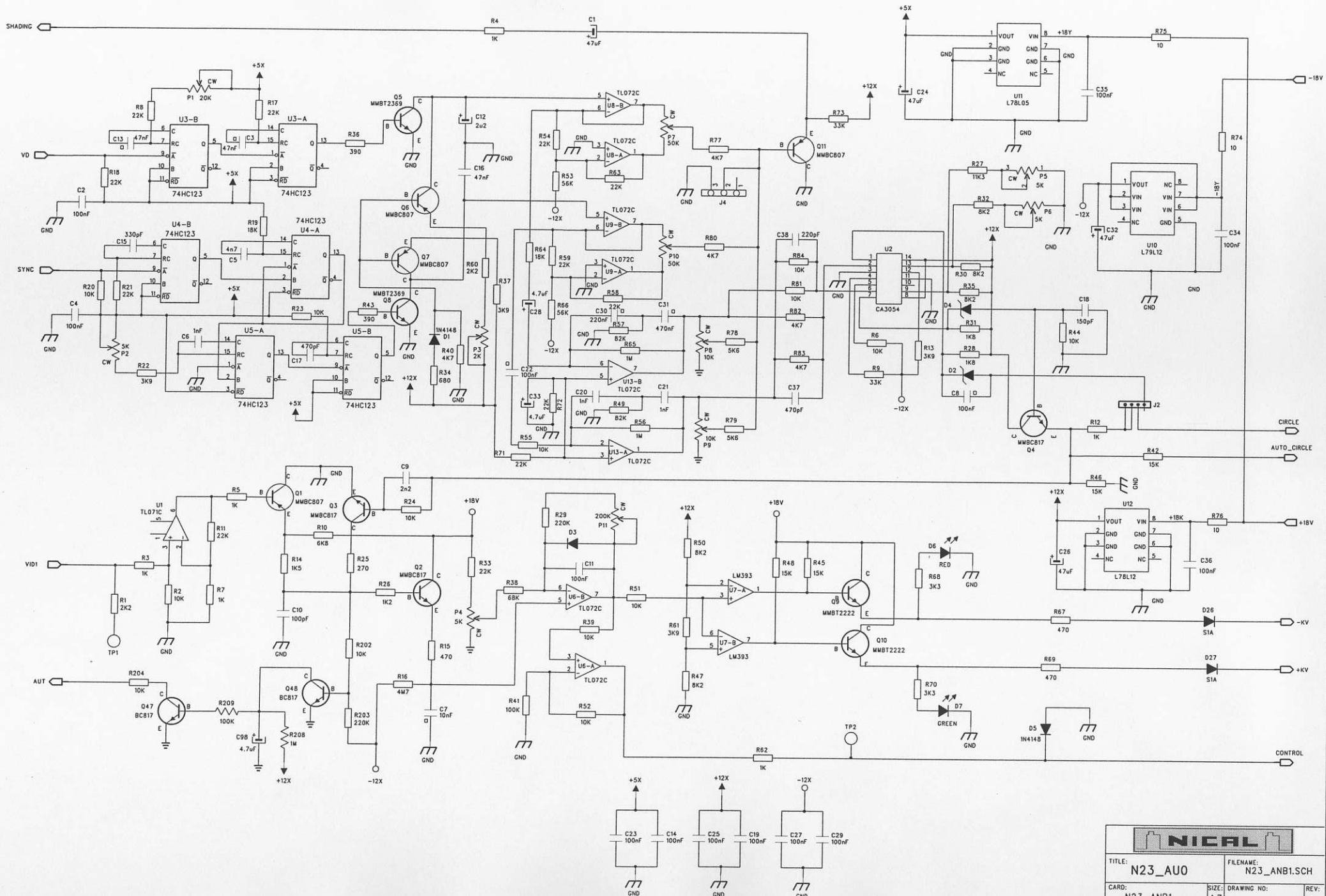
TITLE: MOTHER-BOARD		FILENAME: N23_MB0.sch	
CARD: N23-MB0	SIZE: A3	DRAWING NO:	REV: 0
DATA: 24/02/03	SHEET: 2 OF 2		

D

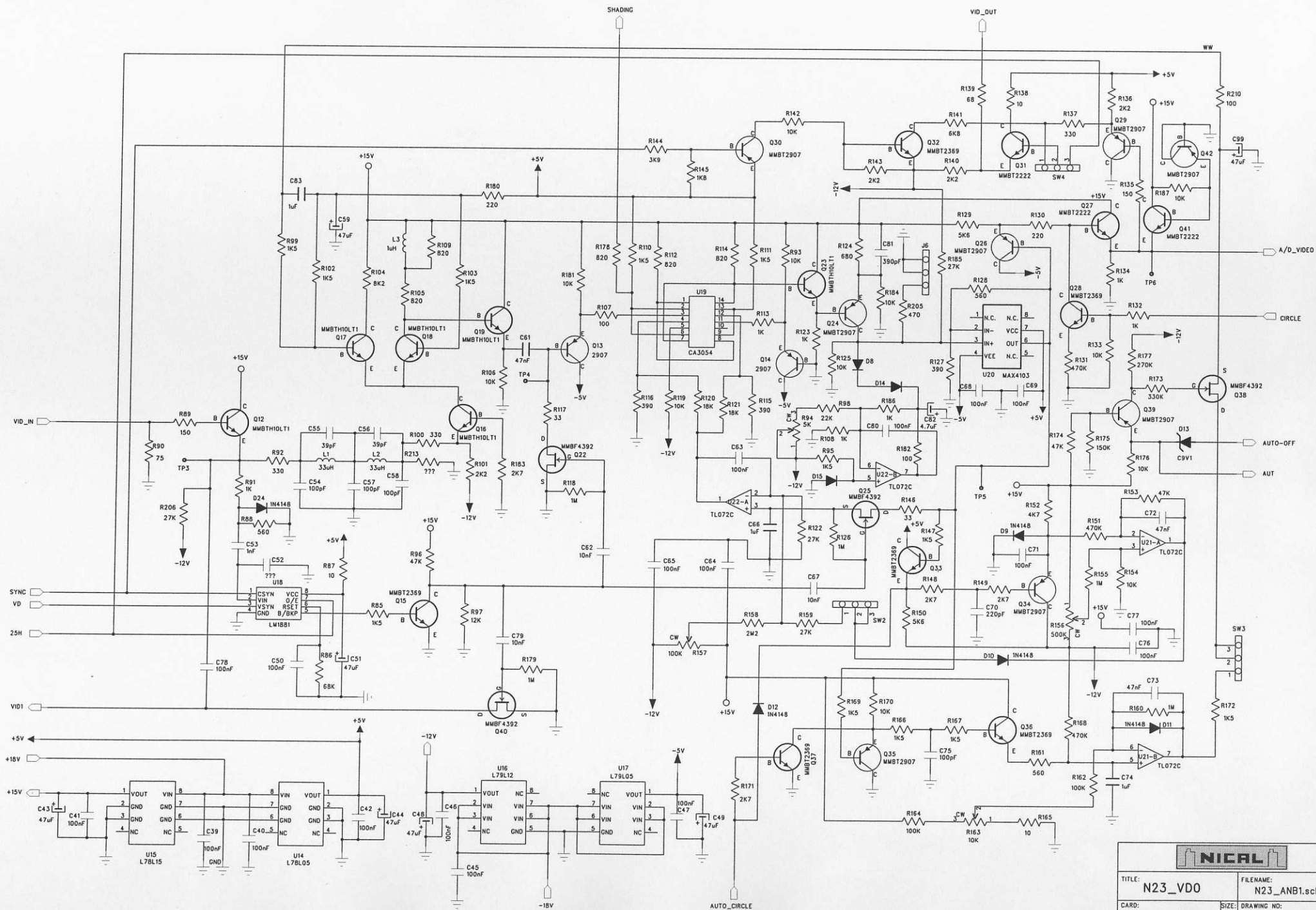
C

B

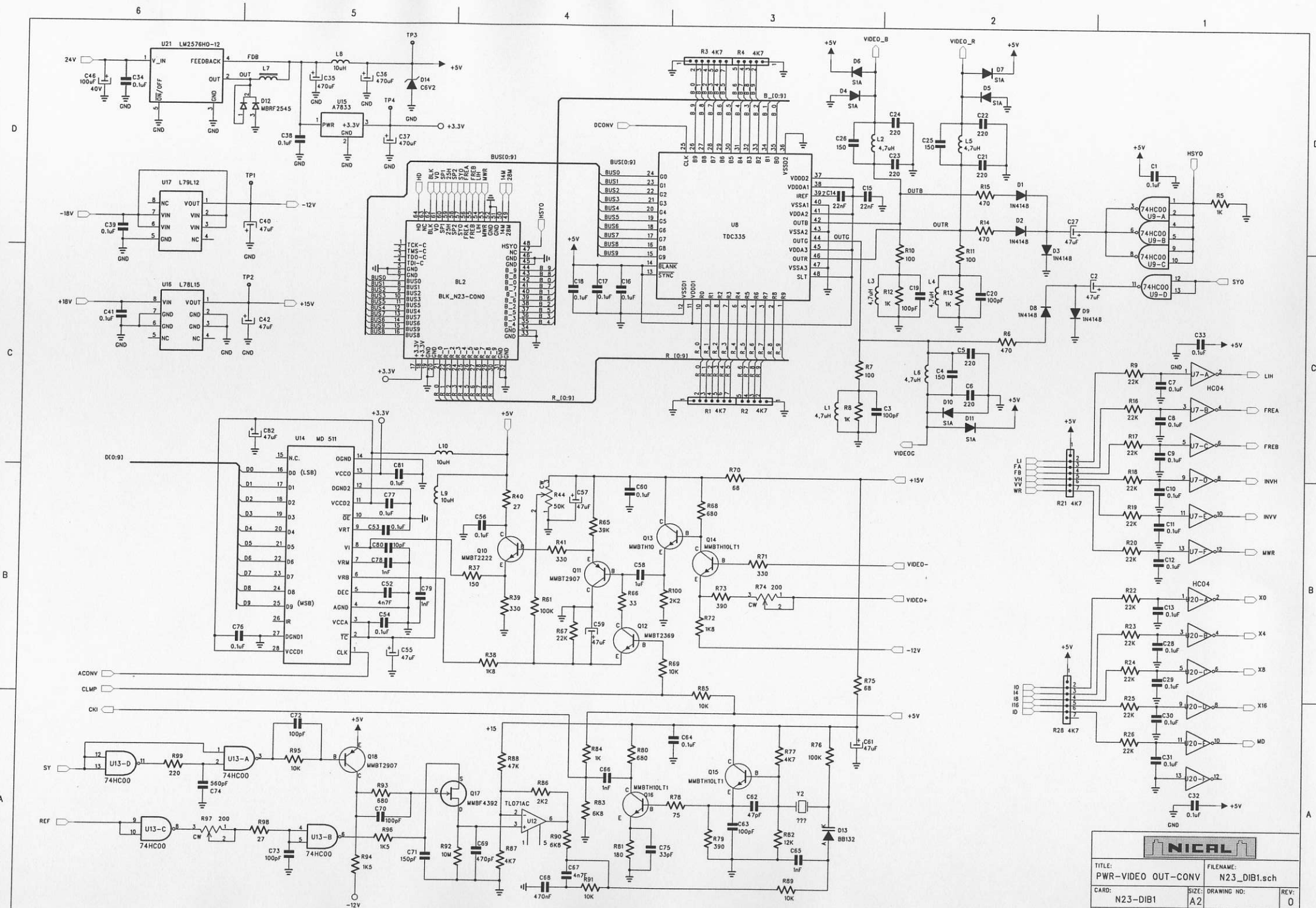
A



NICAL			
TITLE: N23_AU0		FILENAME: N23_ANB1.SCH	
CARD: N23_ANB1	SIZE: A3	DRAWING NO:	REV: 0
DATE: 14/04/03		SHEET: 2 OF 4	



		
TITLE:	N23_VDO	
FILENAME:	N23_ANB1.sch	
CARD:	N23_ANB1	SIZE: A2
DRAWING NO:	REV: 0	
DATA:	14/04/03	SHEET: 3 of 4



D

C

B

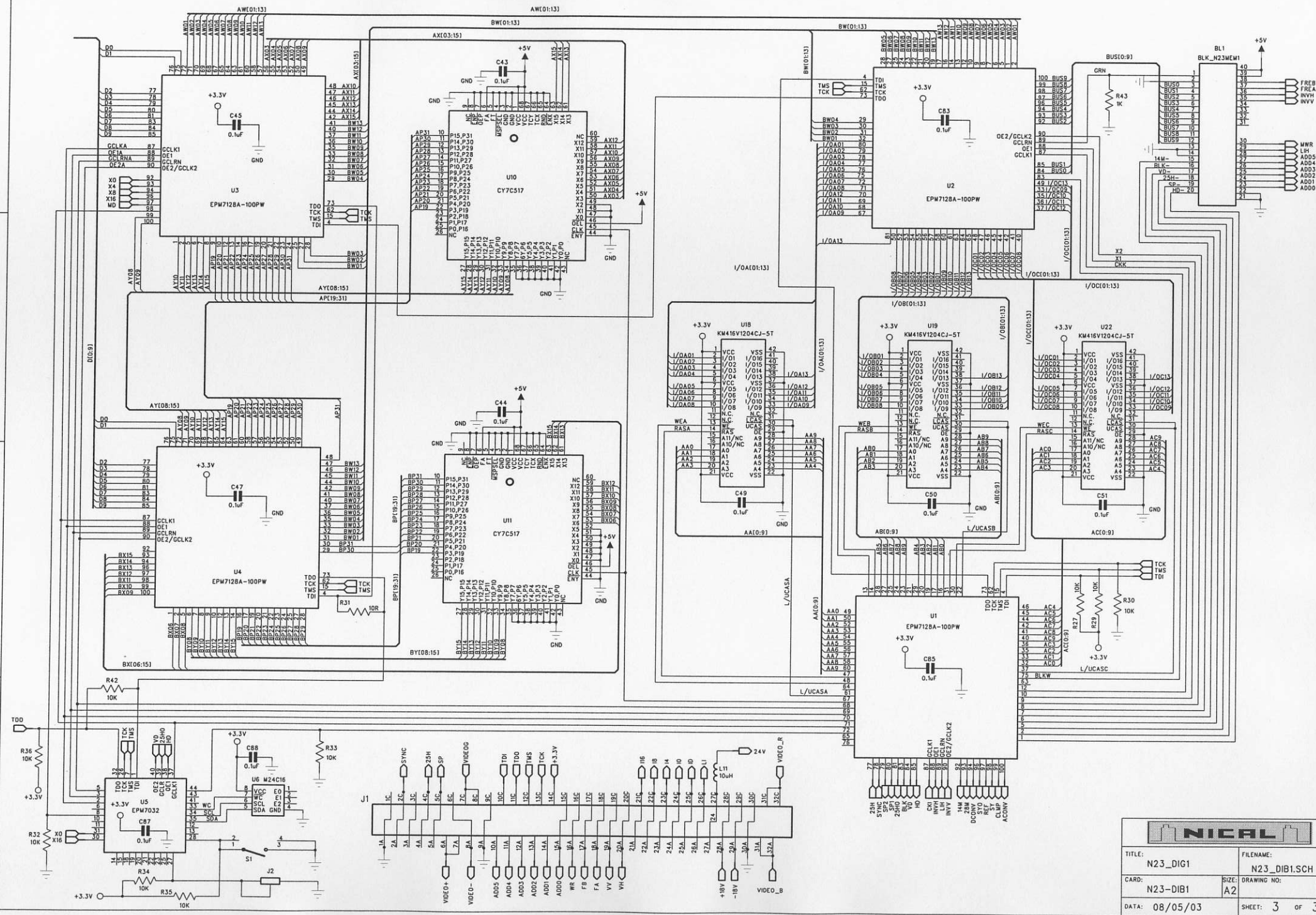
A

D

C

B

A



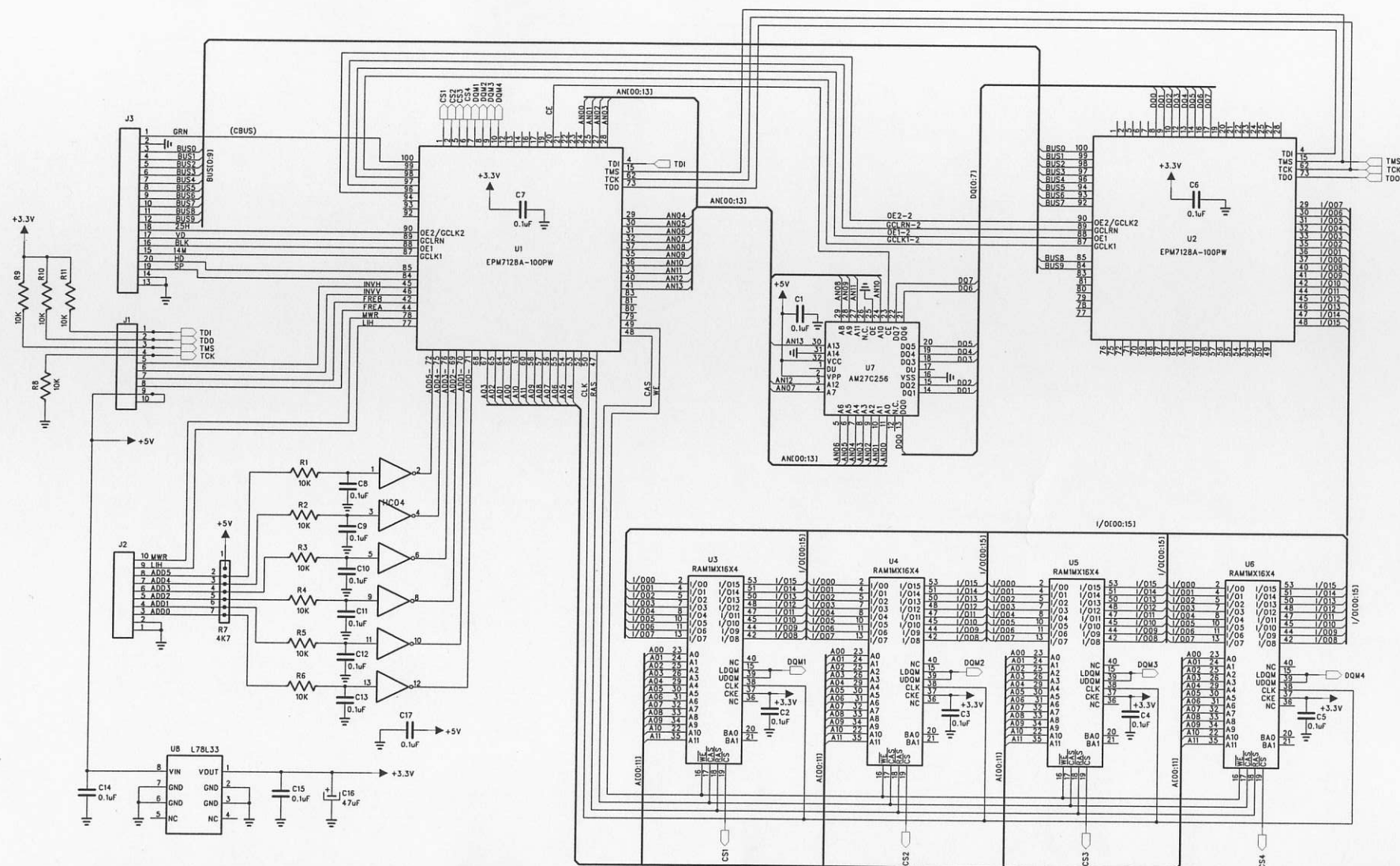
TITLE:	N23_DIG1	FILENAME:	N23_DIB1.SCH
CARD:	N23-DIB1	SIZE:	A2
DATA:	08/05/03	SHEET:	3 of 3

D

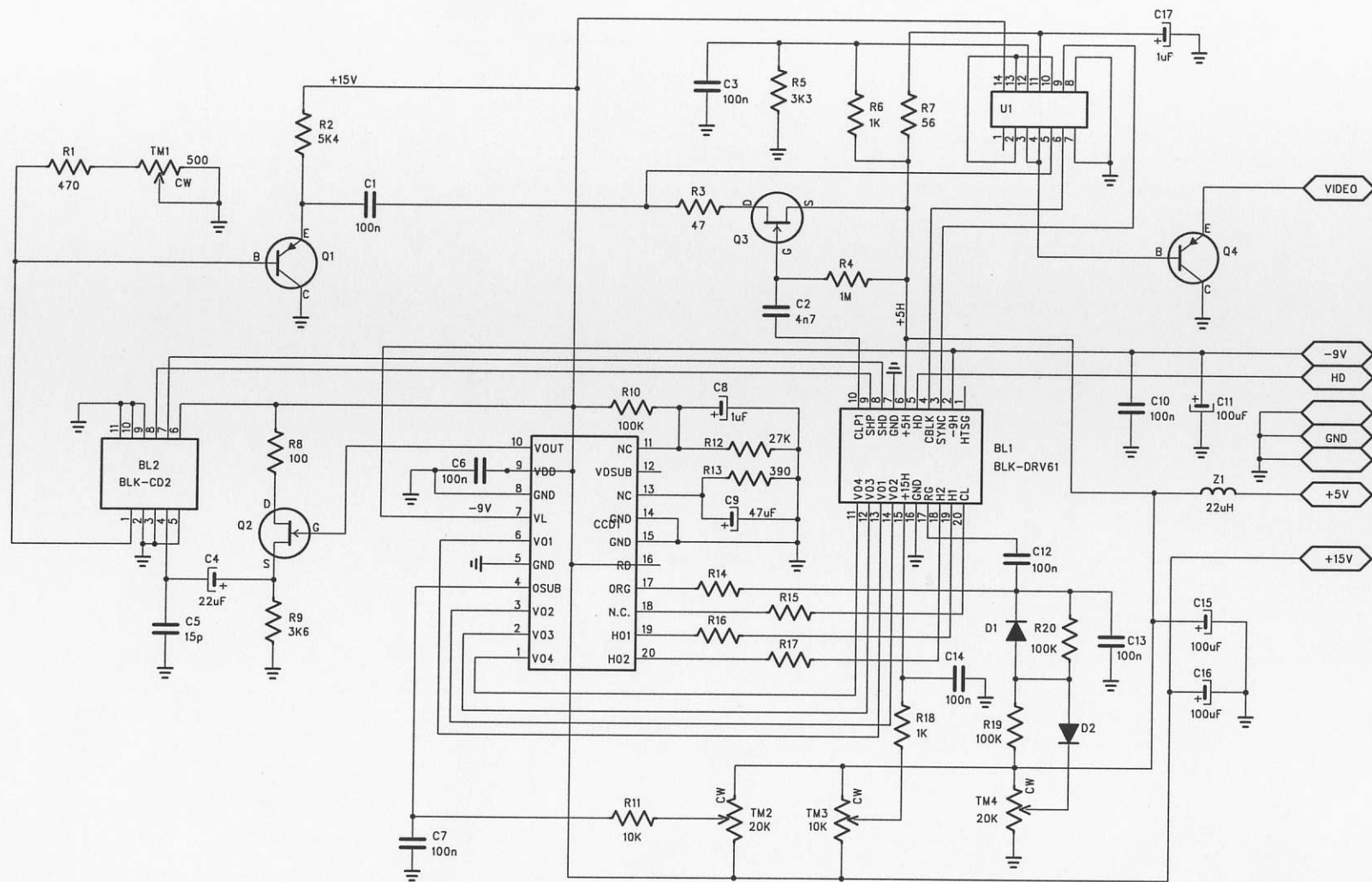
C

B

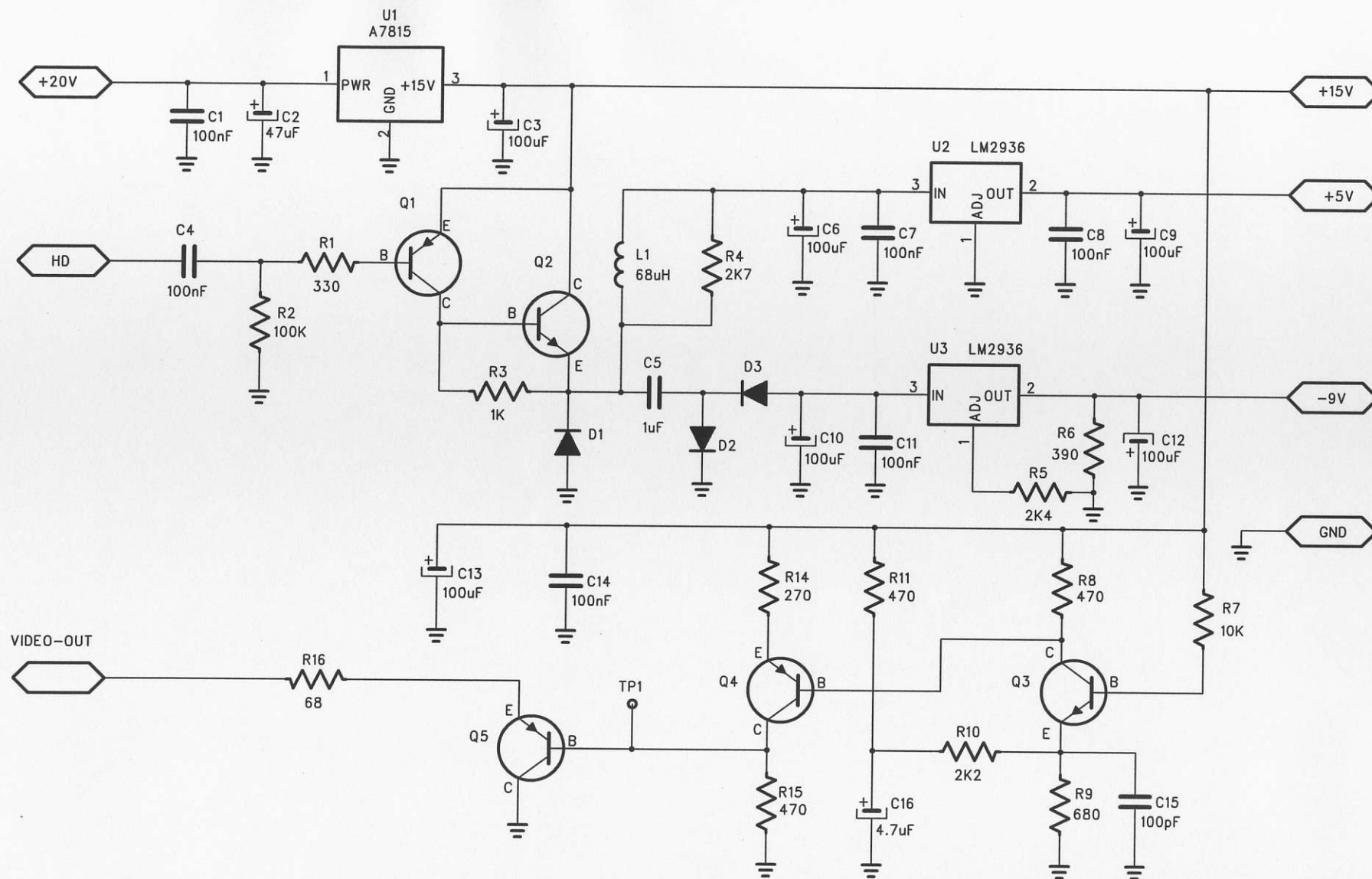
A



TITLE: BLOCCHETTO MEMORIE		FILENAME: N23_MEM1.SCH	
CARD: N23-MEM1	SIZE: A2	DRAWING NO: REV: 0	
DATA: 04/06/03		SHEET: 2 OF 2	



TITLE: N23-XCD01		FILENAME: N23_XCD01.sch	
CARD: XCD01	SIZE: A3	DRAWING NO:	REV: 0
DATA: 18/02/03		SHEET: 2 of 2	



			
TITLE: N23-XCD02		FILENAME: N23_XCD02.sch	
CARD: XCD02	SIZE: A4	DRAWING N:	REV: 0
DATA: 18/02/03	SHEET: 2	OF	2